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Worldwide Report

TELECOMMUNICATIONS POLICY, RESEARCH AND DEVELOPMENT

(FOUO 20/81)

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CONTENTS

SUB-SAHARAN AFRICA

INTER-AFRICAN AFFAIRS

Kuwait, Tunisia Sign Loan Agreement for Telecommunications Project (MARCHES TROPICAUX ET MEDITERRANEENS, 6 Nov 81)........... 1

USSR

Methods for Locating Breaks in Optical Cables (S. M. Vernik, A. M. Kuznetsov; ELEKTROSVYAZ', Sep 81)..... 2

Climatic, Mechanical Tests of 'Iztok' Communication System (Ya. Ya. Silin'sh; ELEKTROSVYAZ', Sep 81) 10

Development of Communications in Belorussia (I. M. Gritsuk; ELEKTROSVYAZ', Sep 81) 16

Rural Wire Broadcasting Discussed (ELEKTROSVYAZ', Sep 81) 21

Ways of Developing Rural Telephone Communication, Wire Broadcasting (G. Monina; ELEKTROSVYAZ', Sep 81) 23

Automatic Telephone Exchange 'Kvant' for Agencies, Industry Discussed (G. Matlin; ELEKTROSVYAZ', Sep 81) 26

INTER-AFRICAN AFFAIRS

KUWAIT, TUNISIA SIGN LOAN AGREEMENT FOR TELECOMMUNICATIONS PROJECT

Paris MARCHES TROPICAUX ET MEDITERRANEENS in French No 1878, 6 Nov 81 p 2812

[Text] Tunisian-Kuwaiti cooperation, details of which we have reported several times, has materialized again. In a ceremony held on 31 October, at the headquarters of the Arab Fund for Economic and Social Development (FADES) in Kuwait, the Tunisian ambassador to Kuwait, Mohamed Megdiche, and the president of the fund, Mohamed Imady, signed a loan agreement for a total of 3.7 million Kuwaite dinars or about 6.475 million Tunisian dinars.

The loan--at a 6 percent interest rate and repayable in 15 years, with a 4-year grace period--will be applied to finance the outlay of foreign exchange required to build the Tunisian section of the fourth inter-Arab telecommunications project (Algeria-Tunisia) with an estimated cost of 6.4 million Kuwaiti dinars.

The project envisages expanding and improving the telecommunications network between the Magreb countries with the installation of coaxial cables and multiplex circuits for national and international communications.

One should remember that the FADES has already granted several loans to Tunisia and these loans total 27.2 million Kuwaiti dinars.

It should also be pointed out that, last week, the deputy director general of the Kuwaiti Fund, Badr El Hamaidi, was in Tunis where he conducted talks with Tunisian officials, mainly with Minister of Plan and Finance Mansour Moalla, on the subject of cooperation between Tunisia and the Fund, and on ways to increase this cooperation. Badr El Hamaidi also studied with the minister of transports and communications, Sadok Ben Jomaa, a project to modernize the basic infrastructure of the railroad line between Tunis and Bordj Cedria and he mentioned that four other projects will be undertaken in 1982. These projects are: the development of the Oued Siliana region, the drainage of the Mateur region, the utilization of waste water for agriculture in Tunisia and, finally, the building of an asphalt road in Beja. The Kuwaiti Fund is reported to be also prepared to finance a project to build a 70-kilometer railroad line between Gabes and Medenine. This railroad line, where construction work is scheduled to start next year, will cost in the region of 20 million Tunisian dinars.

It was announced in Tunis that the crown prince of Kuwait, who is also the president of the Council of Ministers, will pay an official visit to Tunisia this coming December.

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METHODS FOR LOCATING BREAKS IN OPTICAL CABLES

Moscow ELEKTROSVYAZ' in Russian No 9, Sep 81 pp 25-28

[Article by S. M. Vernik and A. M. Kuznetsov, submitted 4 Aug 80]

[Text] Successful operation of communication lines is determined to a considerable degree by the possibility of locating the exact point of their break. The solution of this problem is usually connected with great difficulties both in developing measurement methods, and in developing measuring instruments. For optical cable communication lines (OKLS), particularly for long lines with an attenuation of the order of 30-40 dB, the solution of this problem is connected with additional difficulties caused by the complexity of the processes of propagation and reflection of light signals in optical fibers (OV).

Let us examine the possible methods of locating the break points of OV and OK [optical cables] as a whole and particularly the methods suitable for using on long lines.

As is known, not any actual breakdown of an optical fiber (OV) totally stops the propagation of a signal. For example, a break of OV with a vertical shear and separation of OV in the cable by 2-5 μm leads only to an insignificant increase in the attenuation of the signal. Therefore, a break of OV will be considered a damage at which the propagation of light energy stops completely. There exist three methods for locating the breaking point in OV.

The method of measuring light energy radiated into the surrounding medium is used for quality control of initial semifinished products -- "moldings" from which OV are stretched, as well as for locating OV breaks and great (of the order of 2-3%) nonuniformities. Quality control of moldings is accomplished by probing them with radiation of a gas laser of the visible spectrum (λ = 0.62 μm). Luminescence is observed at the points of OV nonuniformity. The quality of the molding can be judged by the intensity and the number of the luminescent points. By statistical processing of the results of visual observations, it is possible to establish the correlational connection between the quality of the molding and the OV nonuniformity.

At the points of great OV nonuniformities, some of the energy of light signals is radiated into the surrounding space. In this case, the measuring signal introduced into the OV consists of powerful light pulses (of the order of 1-3 W) repeated with frequency of 1-5 kHz. The light signals radiated into the surrounding space are picked up by the photodetector of the receiving device and are transformed into pulses of current (voltage) which are then amplified in the narrow-band amplifier which is characterized by a great gain factor and is tuned to the frequency of the repetition of the light pulses.

In the process of measurements, OV moves in relation to the photoreceiver, and the intensity of the radiation in it becomes fixed. The function of the distribution of the power of the radiated signals along the length of the OV characterizes the distribution of nonuniformities. The OV break point usually corresponds to the high amplitude of the emitted signal. As is shown by preliminary results, this method can be realized if the dynamic range of the receiving device is 110-140 dB.

The method of measuring intensity of the Rayleigh backscattering is used widely in measuring the distribution functions of nonuniformities along OKLS and the attenuation equivalent of OV and OK.

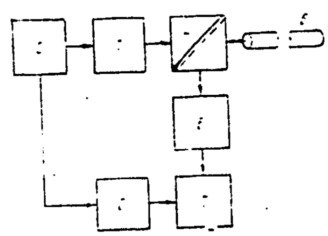

Figure 1.

The functional diagram of the measuring device used in this method is shown in Figure 1. The OKLS 5 is probed by short (2-5 ns) high-power light pulses (1-2 W) which are introduced into the OK through the differential device 4. The reflected backscattering flux is received on the receiving device 6; the screen of the ELT [electron-ray tube] 7 (or some other indicator) shows the dependence of the intensity of the backscattering flux on the length of the line (or the time of signal propagation), as well as the point of OV nonuniformities. The point of OV break is characterized by a sharp drop of the scattering power.

The main drawback of this method is the low level of the backscattering flux, which makes it impossible to use this method for locating breaks in long OKLS due to insufficient sensitivity of the receiving device. Moreover, in the presence of relatively great nonuniformities (which is the case at the existing level of the manufacturing technology of OV and OK), the power of the counter flux of light pulses could be considerably higher than the power of the Rayleigh scattering flux. This distorts the results of measurements.

The location method of determining breaking points of OV is identical to the pulse method of measuring the distribution functions of nonuniformities which is widely used on cable communication lines.

Figure 2.
Key: 1. Break

The functional diagram of the measuring device used in the location method is analogous to the one shown in Figure 1. The generator of sounding light pulses 1 of 5-10 ns is triggered by the electronic driving oscillator 2 which, simultaneously or with some delay (τ_3), triggers the scanning generator of the ELT 3. The sounding pulse passes through the differential system 4 to the OV 5 being measured. Part of the energy reflected from the OV nonuniformities creates a reverse light flux which arrives at the photodetector 6 and transforms into voltage pulses. Having been amplified in the amplifier 7, they are delivered to the vertical plates of the ELT, causing the deflection of the electron beam upward or downward along the axis y from the middle line. The arrival time of the reflected pulses is registered in the scale of the scanning time s(t) which can easily be converted into the distance, km, to the place of reflection (Figure 2):

$$x = 0{,}5\, s\,(t)\, v, \qquad (1)$$

where v is the light energy propagation speed.

The breaking point is determined by the distance x beyond which the reflected pulses do not arrive to the receiving device.

The main difference of the parameters of the circuit of Figure 1 which is used for measuring breaking points and distribution functions of nonuniformities by the location method from the parameters of analogous circuits intended for measuring the intensity of the backscattering flux is that the receiving device used in the location method has a narrower operating frequency range. This makes it possible to have an amplifier of the receiving device with a dynamic range of 50-60 dB. Moreover, as was mentioned before, the signals reflected from the nonuniformities and breaking points usually are by several orders higher than the intensity of backscattering fluxes. Thus, this method makes it possible to conduct measurements on long OKLS.

It can be seen from examining the functional circuit of Figure 1 and the description of its operation that it is analogous to the widely known circuits used in devices of the P5-type or UIP-type [3] which are intended for studying distribution functions of nonuniformities and for locating breaking points of cable conductors as one of the great nonuniformities in which the reflection coefficient is equal or close to one. This fact is quite important, because it makes it rather simple to design a device for locating OV breaks in the form of an attachment to the series-produced P5-type instruments. However, when measuring OK, it is necessary to consider the special characteristics of the propagation of optical signals and reflections of optical fluxes in OV which lead to the appearance of additional errors.

Location Method Errors. Optical signals attenuate when they are transmitted through OV due to losses in OV, which leads to a decrease in the energy of the sounding light pulse W_0 at the end of an OK with length L to the value

$$W_L = W_0 e^{-0.23 \alpha L}, \qquad (2)$$

where α is the attenuation factor of OV, dB.

The energy of the pulse reflected from the end of the line, when it is fully reflected, measured at the beginning of the line is

$$W_{отр} = W_0 e^{-0.46 \alpha L} \qquad (3)$$

Knowing the attenuation value of the regeneration section of the OKLS $a_{рег}$, it is possible to determine the minimum dynamic range of the measuring device $a_{мин} = 2 a_{рег}$. In order to determine the dynamic range of the measuring device, it is necessary to increase $a_{мин}$ by the attenuation, $a_{i\,отр}$ which characterizes energy losses during reflection at a point situated at the distance L_i from the beginning of the OKLS. These losses are stochastic in nature and are a function ψ_i of a set of stochastic values: modulus of the reflection coefficient at the i-th point P_i; distribution function of angles at which light waves of various modes reflect from the surface of the OV break $\varphi_{i\,\mu}$, where μ is the number of the mode of the light wave. Moreover, $a_{i\,отр}$ depends on the aperture angle of the OV θ and the conditions of the propagation of individual modes in the OV. Thus,

$$a_{i\,отр} = \psi_i (P_i, \varphi_{i\,\mu}, \theta) \qquad (4)$$

and is stochastic in nature.

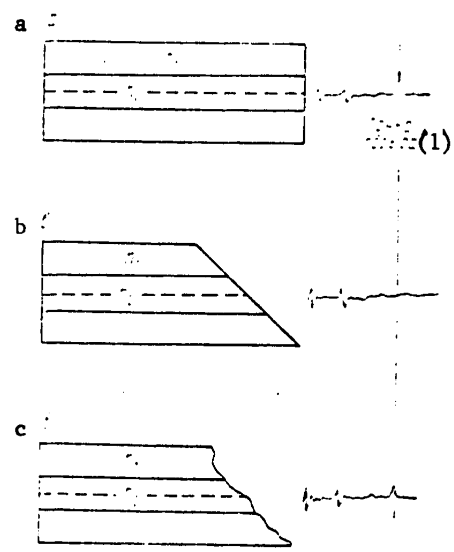

Figure 3.
Key: 1. Breaking point

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Figure 3 shows possible profiles of OV breaks and oscillograms of the reflected signals corresponding to them. The smallest losses occur if the break surface is perpendicular to the OV axis (Figure 3a), and the largest losses occur if the angle of the break plane with the OV axis is equal to 45 degrees (Figure 3b); in the case of a complex surface of the break (Figure 3c), the value of the losses is stochastic in nature. Besides the losses as a result of reflection, it is necessary to consider also the losses in the differential assembly of the measuring device a $_{диф}$. Consequently,

$$a_{ну} = 2\,a_{рег} - a_{отр} + a_{диф}. \qquad (5)$$

If we limit ourselves to measuring the point of OV break from two sides of the regeneration section, then

$$a_{ну\,мин} = a_{рег} + a_{отр} + a_{диф}. \qquad (6)$$

The maximum value of $a_{иу}$ achieved in practice is 80-90 dB for the power of the sounding pulse of the order of 1-2 W. Losses in the differential device are usually equal to 8-10 dB [1], and the attenuation of the regeneration section is 30-35 dB. It follows from this that a $_{отр}$, if measured on one side of the regeneration section, can be not more than 0-10 dB; when measuring on both sides -- 25-35 dB, which makes it possible to locate the breaking point of the OV with a high degree of accuracy.

The length of the sounding signal can also affect the error in the determination of the OV breaking point [2]. When determining this error, it is necessary to consider the widening of the pulses in the line. When a light pulse with a duration of t_0 propagates along the OV, it widens at the beginning of the fiber due to dispersion of the OV material, due to the dependence of the group delay time on the number of the mode of the light waves, and due to the stochastic spread of values of the group delay time in the OV.

These distortions result in the widening of the sounding pulses as they get farther away from the light source. As a result of this, the resolving power of this method is not the same: it has the highest value at the beginning of the line, and the lowest value at the end of it. The value of the widening of the pulse depends on the type of the fiber and the characteristics of the radiation source.

For example, when an incoherent light pulse with a duration of t_0 is transmitted in a multimode fiber, it widens toward the end of the regeneration section with the length L to the value [1] .

$$t_1 = (t_0^2 + \Delta\tau_d^2 L^2 + \Delta\tau^2 L^2)^{\frac{1}{2}}, \qquad (7)$$

where $\Delta\tau$ -- spread of the group delay time per length unit in a multimode fiber due to the presence of various modes; $\Delta\tau_d$ -- widening of the pulse per length unit due to dispersion in the material and dispersion of the natural waves.

When the natural modes are mixed on the irregularities of the fiber, the pulse at the end of the fiber widens to the value[1]

$$t_2 = (t_i^2 - \Delta\tau_d^2 L^2 - \Delta\tau^2 L_c L)^{\frac{1}{2}}, \qquad (8)$$

where L_c is the average length of the OV on which the total exchange of energy between the modes takes place.

In practice, $L > L_c$; $\Delta\tau \gg \Delta\tau_d$, and the value of the pulse widening Δt is proportional to $\sqrt{L}$. For example, at $\Delta n/n = 0.01$, the spread of the group delay time Δt is 48.4 ns/km, and at a coherent light source, 24.2 ns/km. For a gradient fiber, we have, respectively, 4.84 ns/km and 2.42 ns/km. Thus, with a sounding pulse of $t_0 = 10$ ns and a coherent light source, the pulse widens to 34.2 ns at the end of the first kilometer of the line. These data indicate that there is no point in decreasing the length of the sounding pulses below 5-10 ns.

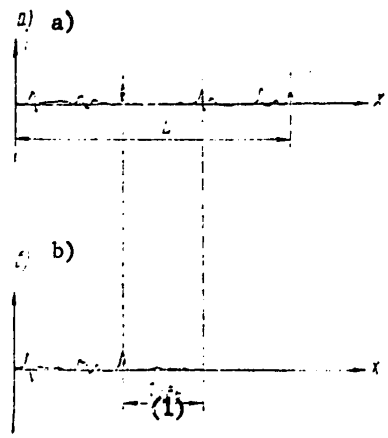

Figure 4.
Key: 1. Uniform

The maximum value of the error in locating a break corresponds to the maximum value of $a_{отр}$, when the reflected pulse is not observed at the breaking point of the OV on the screen of the measuring device (Figure 3b). In this cease, the operator usually assumes that the location of the break is the point of the closest OV nonuniformity on the side of the sounding generator (Figure 4a) which, after the break, has the form shown in Figure 4b. In this case, the measurement error will be determined by the section of a high uniformity $l_{одн}$ of the OV, where no reflected pulses are observed.

With the improvement of the OV quality, $l_{одн}$ will be increasing to the values of the OK factory lengths, because, as a rule, joint reflections occur at the points of OK joints which are registered by pulsed instruments.

By using these reflections, with the aid of the location method, it is possible to determine the factory length of the OK where the break took place.

Conclusions. The analysis of the location method of the determination of the breaking point of OV showed that the possibilities of errors in measurements depend substantially on a number of random factors which can lead to impermissibly great errors. In order to limit them in the process of the construction of OKLS, it appears to be appropriate to measure the nonuniformity distribution functions along the length of the line and to include these characteristics in the operation manual of the OKLS. These characteristics measured on both sides of the regeneration section supplemented by actual data about the length of the construction sections of OK, distribution of nonuniformities, values of reflections at the joints of the factory lengths, and actual attenuation of OK make it possible by their changes to judge about the constancy of OK parameters by periodic measurements of the nonuniformity distribution functions and a more accurate determination of the OV failures. In this case, the characteristic of the distribution functions of nonuniformities obtained in the course of the latest measurements can be used as a reference scale for the determination of the OV failure. Measurements of the nonuniformity distribution functions on both ends of the regeneration section to the break point and after it will contribute to a more accurate determination of the failure point of the fiber.

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CLIMATIC, MECHANICAL TESTS OF 'IZTOK' COMMUNICATION SYSTEM

Moscow ELEKTROSVYAZ' in Russian No 9, Sep 81 pp 12-15

[Article by Ya. Ya. Silin'sh, submitted 15 Nov 78]

[Text] Series production of the integrated analog-digital communication system YeSS ATs "Istok" has been started [1]. In the process of the preparation of the documentation for series production, a complex system of production quality control (KSUKP) of YeSS ATs was developed, guaranteeing a high quality of the station equipment [2].

The KSUKP YeSS ATs includes a complex of organizational, scientific, and technical problems which are solved at all stages of production and operation of the YeSS ATs equipment. This complex includes four groups of problems: general system problems, problems of the stages of designing, manufacturing, and operation.

The general system problems provide for continuous control of the plans of measures for the purpose of quantitative evaluation of the quality of work and the provision of unified metrological and patent-information means for the entire development of the system.

The problems of the designing stage include: the order of the quality control of the design and technical documentation and verification of this documentation by the reliability, metrology, and standardization services; safety program; methods of climatic and mechanical tests, etc.

At the manufacturing stage, the quality of the equipment of YeSS ATs is ensured by the analysis of causes of defects and failures; organization of the optimal input control of materials, semifinished products and components; certification of the equipment and technological processes by quality levels; conducting Quality Days, etc.

The problems of the state of operation include the collection, processing, and submission of information to the designer and the plant about failures of the equipment during the operation in the experimental zone, conducting controlled operation of series stations, establishing the exact amount of spare parts, etc.

The quality and reliability of the YeSS ATs equipment are greatly affected by external climatic and mechanical influences. Moreover, in the process of the manufacturing of equipment, there unavoidably occur hidden defects which are revealed only in the running-in process of the equipment. The developed methods of climatic and mechanical tests included in the KSUKP YeSS ATs made it possible to check rapidly the operating ability of the equipment under various conditions and to reveal the causes of its failures and hidden defects.

Climatic Tests. The reliability of the functioning of YeSS ATs is affected the most by temperature, since most of its electroradio elements (ERE) are sensitive to its changes.

According to specifications for the equipment of this class, it should operate at a higher temperature of +40°C. However, local overheating occurs in some electronic assemblies of the equipment due to the special characteristics of their design. GDR specialists studied the dependence of the overheating temperature $t_{overheat}$ within the bay of YeSS ATs on the released thermal power P_t of individual assemblies located in a given bay [3]. The results of these studies for the middle (curve 1) and end (curve 2) bays of the set are shown in Figure 1.

As can be seen from the curves, at the maximum power release within the bay equal to 400 W, local overheating of the bay located in the middle of the bay set will be ~ 15°C. For this reason, tests of the YeSS ATs components, such as sections, cells, transformers and other ERE, must be conducted at a temperature of +55°C, and not at +40°C.

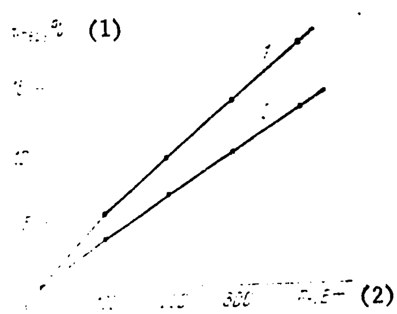

Figure 1.

Key: 1. $t_{overheat}$
2. W

In temperature tests, in order to correctly reflect real operational conditions and to select correctly the conditions of the tests, it is necessary to consider thermal balance of the objects being tested. It has been established that a specimen has to be kept in the testing chamber at the higher operating temperature of +55°C for four hours. But the casing, for example, of the multiple integrated connector (MIS) used in the YeSS ATs reaches this temperature only after four hours, i.e., the time origin of MIS tests must be moved to that time. Heat-releasing objects (powerful transistors, resistors, etc) reach a higher operating temperature considerably earlier, and the stable temperature value of their casings even exceeds the operating temperature in the chamber. All this is shown clearly in Figure 2 which gives the dependence of the air temperature in the testing chamber (curve 1), temperature of the specimen surface (curve 2) and the surfaces of powerful transistors (curve 3) on the testing time.

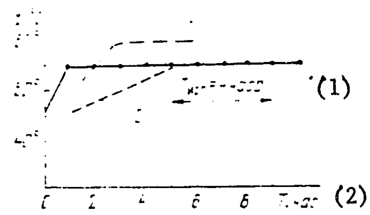

Figure 2
Key: 1. T_{test} = 4 hours
2. Hours

Tests of equipment at lower operating temperatures are conducted in the same way.

Moisture resistance tests of the equipment are also done in a special chamber, where real operating conditions are simulated. It is taken into consideration that under real conditions, the object is under an electrical load which affects the formation of dew on the casing of the object and lowers by one order or more the resistance of the insulation of the printed circuit plates, transformers, etc.

The next test of the equipment for various transportation conditions is done in a cyclic mode, with variable ambient temperature and humidity. After these tests, the equipment must be acclimatized under normal conditions at an ambient temperature of $+25\pm10^{\circ}C$ and humidity of $65\pm15\%$ in the course of 6-24 hours. This is necessary, because all electrical parameters of the equipment must return to the initial normal state.

It is considered that the equipment has successfully passed the tests, if its certain electrical parameters did not exceed the established limits during these tests.

Mechanical Tests. In order to check the equipment completely under various modes of transportation and operation, it is tested for mechanical, vibration, and shock effects. The sample is placed on a special platform which is set into vibration with variable acceleration and frequency.

YeSS ATs equipment can be transported by motor vehicles, railroad, sea and air. Therefore, it is necessary to examine the conditions corresponding to these types of transportation. Figure 3 shows the dependence of acceleration g on frequency f for various types of transportation obtained in [4-6]: curve 1 -- plane, 2 -- ship, 3 -- motor vehicle, 4 -- container carrier. The same figure gives the dependence of g on f for shock (curve 5 -- for packaged equipment, curve 6 -- for unpackaged equipment) and vibration (curve 7) effects. Curve 8 corresponds to the existing conditions of testing for vibration effects. The frequency range (10-500 Hz) was determined by the passband of the measuring instruments used.

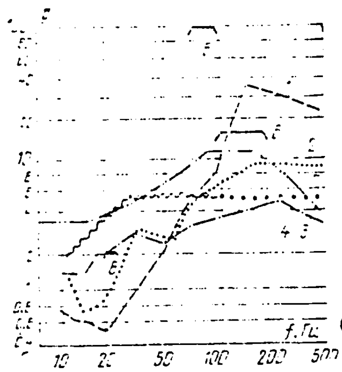

Figure 3.
Key: 1. Hz

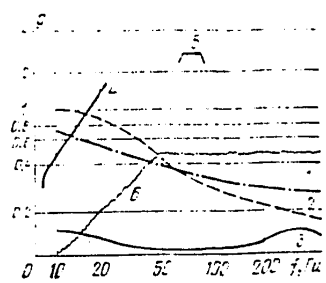

Figure 4.
Key: 1. Hz

As can be seen from Figure 3, the greatest accelerations in the equipment occur during transportation by plane, and all types of transportation are characterized by an increase in acceleration from the frequency of 10 Hz.

Tests of samples for sinusoidal vibration were conducted on a special stand. For such tests, it is necessary to use only an electrodynamic stand (for example, VEDS 400) which makes it possible to obtain a sliding sinusoidal signal with a speed of one octave per minute with automatic adjustment of the amplitude of movement and acceleration. Vibration stability tests were conducted with voltage turned on, i. e., under load, and those for vibration strength -- under no-load conditions with visual and electrical checking of the sample after the tests. In the process of developing a sample, it is recommended to use stiffer tests (by 30-50%) than the existing ones for ensuring the margin of safety of the structure during periodic plant tests.

GDR specialists proposed to simulate transportation conditions by means of 1000 pulse shocks of 4 mc at an acceleration of 100 g, unloading jobs -- by throwing the equipment from a height of up to 85 cm or by six shocks with an acceleration of up to 400 g.

Figure 4 shows the dependence of g and f occurring in the YeSS ATs obtained in mechanical tests of a sample for its stability to external effects: curve 1 -- during the switching of tumblers; 2 -- during the replacement of cells; 3 -- during accidental shocks during the operation of the equipment. Curve 4 shows the existing conditions of testing for the detection of resonance frequency in the equipment; curves 5 and 6 -- testing conditions accepted for YeSS ATs for shock and vibration stability. As can be seen from Figure 3 (curve 8) and Figure 4 (curve 4), the existing testing conditions used at plants manufacturing ATS [automatic telephone exchanges] cannot ensure qualitative checking of the YeSS ATs.

Difficulties are caused also by discrepancies in the normative technical documentation for ERE [8], where 20 degrees of rigidity are given for vibration effects which do not correspond to the effects occurring during operation. For example, rigidity degrees I, II and V for the frequency ranges, respectively, of 10-35, 10-60, and 10-100 Hz have the same acceleration of 1g, which is not substantiated scientifically at all.

As was shown by the studies (Figure 4), tests for the vibration stability of cells and sections of the equipment of YeSS ATs should be conducted in the frequency range of 10-500 Hz with an acceleration of up to 0.5 g. Shock stability test must be conducted at an acceleration of 2.5 g and the length of the shock pulse of 6 ms.

In order to ensure a high quality of standard replacement elements (TEZ) of the YeSS ATs equipment, they are subjected to accelerated reliability tests in the process of manufacturing. A method was developed according to which, after mechanical effects on TEZ, they are tested for nonfailure operation under a maximum electrical load in a special compact chamber at a temperature of +55°C in the course of 1000 hours. These tests showed the possibility of revealing design and technological failures of TEZ.

In the manufacturing process of the equipment, there unavoidably occur hidden defects which lead to running-in failures. Short-term forced climatic and mechanical effects make it possible to reveal these defects and reduce the running-in failures [9, 10], which is confirmed by the tests of the experimental specimens of the YeSS ATs "Istok".

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10233
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USSR

DEVELOPMENT OF COMMUNICATIONS IN BELORUSSIA

Moscow ELEKTROSVYAZ' in Russian No 9, Sep 81 pp 1-3

[Article by I. M. Gritsuk, minister of communications of the Belorussian SSR: "Results and Directions of the Development of Communications in Belorussia"]

[Text] Communications workers of Belorussia, just as all Soviet people, have started working on the fulfillment of the tasks of the Eleventh Five-Year Plan. Workers, engineers, technicians, and the entire personnel of the communications industry of the republic are concentrating their efforts on complete fulfillment of the resolutions of the 26th CPSU Congress and instructions of the USSR Ministry of Communications, realizing that faultless operation of the means of communication is an essential condition for the intensive development of the entire national economic complex.

This industry commenced the current five-year plan with fairly good technical equipment which makes it possible to conduct effective work on the improvement of the services to the population and the national economy of the republic with all types of communications, increasing labor productivity and reliability of the means of communication.

The preceding Tenth Five-Year Plan was the years of further strengthening of the material and technical base of communications. It will suffice to say that the five-year target for the introduction of the fixed capital was fulfilled in Belorussia in 4 years, and the value of the capital increased almost by 46%.

Year after year, the allotted capital investments were used systematically, and their volume increased by 36% in five years. This made it possible to increase the length of intercity telephone channels almost 1.7-fold and introduce new capacities of automatic intercity telephone stations. The industry was modernized on a new technical basis. Main lines were equipped with transmission systems K-3600, K-1920, K-1020, BK-960, and the intraoblast networks were equipped with system K-300, K-60-P which replaced KV-24, KV-12, V-12-2, and ME-8 systems.

A large volume of work was done on the equipping telephone channels with semiautomatic and automatic equipment; the level of automation reached 92%. On the whole, this made it possible to automate tandem operation by 94%, and to handle outgoing calls, whose number increased by 65%, without increasing the number of operators.

The number of intercity coin telephones (MTA) increased by 40% during the five-year plan, which provided additional convenience for the population and guests of the republic's capital, the heroic city of Minsk, and other cities and produced a definite economic effect. The 240 MTA of Minsk (including automated intercity public call stations operating twenty-four hours a day) are attended by 23 people. These MTA handle about 17,500 outgoing calls a day. The handling of such a number of calls through operators via Minsk MTS [intercity telephone exchange] would require a staff of about 300 telephone operators.

Telegraph communications were also developed. The capacity of the network of subscribers' telegraph exchanges increased by more than 40% during the five-year plan; the first section of the data transmission network which was completed covers all rayon communication centers. Telegraph networks were equipped with DUMKA, "Interval", KANT, and TAKT equipment and with automatic switching crossbar exchanges AT-PS-PD, ATK-PD, and ATK-20 U.

The republic searched for ways of improving the organization of telegram deliveries and lowering the costs of the delivery service. The experience of the Minsk post office in creating a reference telephone card file deserves attention. It makes it possible to transmit telegraph messages to the addressee by phone (including business phones).

In the republic, telephones were installed in about 75% of the apartments of the heads of rural communication departments (OS), which made it possible in 1980 to deliver to rural residents and receive from them about 60,000 telegrams in the evenings after the business hours of OS and during holidays.

The city and rural telephone communications were developing at an accelerated pace. For example, the capacity of GTS [city telephone networks] increased 1.47-fold and that of STS [rural telephone networks] increased 1.57-fold. Work was done on speeding up the operation of installed capacities. Their utilization factor as of 1 Jan 1981 was 94% for GTS and 80% for STS.

The introduction of centralized repair services at the GTS of Minsk and other oblast centers made it possible to perform up to 94.7% of repairs within the established time limits, to increase labor productivity and create additional convenience for the population by concentrating transportation facilities and human resources. The number of coin telephones at GTS increased by almost 30%; the republic occupies the fourth place in the country with respect to their number per capita.

The automated rural telephone network is based only on crossbar exchanges. At more than 900 kolkhozes and sovkhozes, telephone intercommunication facilities (VPTS) were reconstructed. At one half of these farms, these jobs were combined with the organization of the dispatcher's telephone communication service, and the volume of capital investments used just for these purposes was on the order of 30.5 million rubles. The dispatcher's communication service organized between rayon centers and kolkhozes in 33 rayons of the republic proved to be highly effective for the national economy.

The rural communication network uses many thousands of kilometers of KSPP-type cables with which a considerable number of connecting lines were organized with the aid of analog and digital channel-forming equipment during the years of the Tenth Five-Year Plan. However, under the conditions existing in Belorussia, it would be wrong to disregard the possibility of increasing the number of connecting lines by suspending additional aerial cables with their subsequent multiplexing.

The television network of Belorussia is based on the transmitting television stations of the metric-wave band of the types "Len", "Uragan", "Yakor'", and "Zona". During the past five-year plan, three powerful relay stations were built, which made it possible to improve the reception of the first television program for 90% of the republic's population, of the second (republic) program -- for 70% and of the third program -- for 16%.

The wire-broadcasting rediffusion network has 3.6 million loudspeakers. More than 700,000 loudspeakers were installed during the five-year plan, and their density increased to 37.6 per one hundred people, including 30.2 paid loudspeakers.

In order to provide better postal services to the population, more than 250 new post offices were opened; 1500 out of 4400 post offices meet the requirements of "enterprises of high standards". Twenty-eight new buildings of rayon post offices were built, six central enterprises, 210 shops and sections were fully mechanized, and 450 primary electronic machines were introduced for mechanizing postal money-handling operations. Rural mailmen deliver more than three million pieces of mail a year to homes of the population, which contributes to the raising of the effectiveness of the utilization of rural labor resources.

The introduction of a complex of organizational and technical measures made it possible to increase labor productivity of the communications workers in the republic by 24%, save 5.7 million rubles against the goal of 4.5 million rubles and to relieve more than 5500 employees.

The steps of the economic growth in the Eleventh Five-Year Plan are steep, and we must take bigger strides than in the last five-year plan. In 1981 and during the five-year plan as a whole, communications workers of Belorussia are faced with extensive tasks of technical improvement of networks, raising the effectiveness of the utilization of the fixed capital, and improvement of the operation of all types of communication.

It is planned to increase considerably the length of intercity telephone channels, to build new AMTS [automatic long-distance telephone exchanges]in Brest (in 1981), Minsk, Gomel', Mogilev, to expand the AMTS in Grodno and to complete the automation of the zonal communications in the republic.

The number of outgoing long-distance calls must be increased 1.6-fold with a stable number of employees; the number of automated channels will increase more than 2.3-fold.

The telegraph network will be developed further. New AT-PS-PD stations will be built in Mogilev and Brest, the subscribers' telegraph network will increase by almost 25%, and the completion of the construction of a low-speed data transmission network will make it possible to cover the entire agricultural and industrial complex of the republic. Provisions are made for considerable capital investments for equipping this subbranch with new electronic devices.

As the number of families having home phones increases, the method of transmitting telegrams by phone will be introduced more and more actively. In 1983, it is planned to complete the installation of telephones in the apartments of heads of rural communication departments, which makes it possible to create favorable conditions everywhere for delivering telegrams to rural residents after the business hours of OS and on holidays.

The capacity of urban and rural telephone networks will increase 1.3-fold; in 1984, there will be more than one million telephones. VPTS in more than 620 kolkhozes and sovkhozes will be expanded in combination with the organization of dispatchers' communication at the rayon center -- kolkhoz level. The number of connecting lines in rural telephone networks will increase by 35%.

In the Eleventh Five-Year Plan, as a result of the introduction of progressive technology, mechanization and automation of production processes, scientific organization of labor, reconstruction and reequipment of enterprises, labor productivity in the industry will increase by 18.8-19%, and not less than 81% of the increment of the production volume will be accomplished due to the growth of labor productivity. On the whole, it is planned to achieve conditional release of 11,700 people of the production staff. We are continuing to search for methods of saving and effective use of material resources, energy, and fuel.

The experiment on wiring of all city ATS [automatic telephone exchanges] by the method of "free spread of station cables" yielded a saving of over 20% and will be the main method in the Eleventh Five-Year Plan.

In 1981, it is planned to complete the reconstruction of the Vitebsk Radio Television Station, to reconstruct the Grodno station in 1982, and build two new television stations during the five-year plan. As a result of these measures, it is envisaged to cover 97% of the republic's territory by one television program, up to 85% -- by two programs, and up to 35% by three programs.

The annual program of the "Belsvyaz'stroy" Trust, which they are fulfilling by their own efforts, will be at a level of 25-27 million rubles, and that of the "Belremstroysvyaz'" will increase by 40%, reaching 14-15 million rubles. It is planned to strengthen substantially the material base of the construction industry. In order to satisfy the needs in special furniture for public buildings, a furniture shop was built with a design output capacity of 650,000 ruble-worth of products. An automated mortar plant with a capacity of 30,000 cubic meters of mortar is in operation, and its second section is under construction. The reinforced-concrete shop with a capacity of 25,000 cubic meters will make it possible in 1984 to produce about 45,000 reinforced-concrete supports and satisfy the needs in hollow decking and high-quality reinforced-concrete products. The production base of the "Belsvyaz'stroy" Trust will be expanded, which will make it possible to produce more than one hundred kinds of nonstandard parts and articles.

Measures are being taken for a more effective utilization of the capital investments allotted for the Eleventh Five-Year Plan; however, in order to solve all problems of the five-year plan in the development and strengthening of the material and technical base of the communication network of the republic, it will be necessary to use also some above-plan credits of the Gosbank and Stroybank of the USSR.

The equipping of the communication network with new equipment, raising of the level of operation of the technical base, increasing labor productivity, expanding socialist competitions at communication enterprises, and spreading advanced experience will make it possible to improve the services of all types of communication to the population and national economy of the republic in Eleventh Five-Year Plan and to realize the main directions of the economic and social development of Belorussia established by the 26th CPSU Congress.

10233
CSO: 5500/1005

USSR

RURAL WIRE BROADCASTING DISCUSSED

Moscow ELEKTROSVYAZ' in Russian No 9, Sep 81 p 47

[Report on the meeting of the Scientific and Technical Council of the USSR Ministry of Communications]

[Text] In December 1980, a meeting was held at the Scientific and Technical Council of the USSR Ministry of Communications on the subject: "Problems of Delivering Programs and Automation of Wire Broadcasting Facilities in Rural Areas."

The discussion of this problem was brought about by the necessity of improving the quality indexes of the wire broadcasting networks and increasing the hours of daily operation of rediffusion stations.

Research, design, and planning organizations and operating enterprises of the USSR Ministry of Communications have done work on the improvement of the technical and economic indexes of wire broadcasting in rural areas by automating the equipment of radio wire broadcasting centers (RTU). Modern equipment has been developed for automatic control systems of RTU located in the zone of confident reception of ultrashort-wave frequency-modulated radio stations: remote control units (DTU) installed on ultrashort-wave transmitters; a device for automating tube amplifiers with a power of 1 kW ("Duet-2"); low-power radio wire broadcasting centers TUPV-0.25X2, TUPV-05 X2 and TUPV-0.1; equipment for transmitting broadcasting programs over the rural telephone communication networks (AVSP), and station-wide automation system (OSA); a unit for transmitting broadcasting programs in systems with IKM [pulse-code modulation].

As a result of systematic introduction of new equipment, about 6000 rediffusion stations were changed to distant control and were fully automated in the last 10 years. Due to this, the quality indexes of rural wire broadcasting improved, the length of daily broadcasting increased, and the number of the attending personnel was reduced.

The Scientific and Technical Council resolved: that the projects directed toward integration of rural stations and external plants of wire broadcasting and telephone communications, as well as measures for centralizing maintenance of rural wire broadcasting and telephone communication facilities are promising; to transmit rayon broadcasting programs to rural radio wire broadcasting centers located in the zones of confident reception of ultrashort-wave frequency-modulated broadcasting stations through standard audio frequency channels; to conclude the development of proposals for reducing external plants of wire broadcasting in rural areas; to define specifications for main design projects necessary for ensuring the integration of equipment and centralization of maintenance of wire broadcasting facilities and telephone communications in rural areas; to give priority to the development of proposals for the operation of automated RTU and for devices for switching standard audio frequency channels for circular messages from rayon centers to automated RTU located in the zone of confident reception of ultrashort-wave frequency-modulated radio stations; to develop proposals for improving the program transmission method and ensuring the automation of RTU in sparsely populated regions located outside the zone of confident reception of ultrashort-wave radio stations; to develop standards for terms and their definitions in application to the systems, structures and devices of radio wire broadcasting centers; to develop standard designs for stations of rural radio wire broadcasting centers with consideration for the installation of new automatic equipment.

10233
CSO: 5500/1005

USSR

WAYS OF DEVELOPING RURAL TELEPHONE COMMUNICATION, WIRE BROADCASTING

Moscow ELEKTROSVYAZ' in Russian No 9, Sep 81, pp 61-62

[Article by G. Monina, from the materials of an industrial and technical seminar]

[Text] In March 1981, an industrial and technical seminar was held in Chelyabinsk on the subject "Ways of Increasing the Effectiveness and Quality of Rural Telephone Communication and Wire Broadcasting". It was organized by the Main Administration of Rural Telephone Communication and Main Radio Administration of the RSFSR Ministry of Communications, Ural Center of Scientific and Technical Propaganda of the RSFSR Society "Znaniye", Chelyabinskaya Oblast Production and Technical Administration of Communication and Chelyabinskaya Oblast Administration Board of NTORES [Scientific and Technical Society of Radio Engineering, Electronics and Communication] imeni A. S. Popov. About 200 specialists, members of the PTUS [Industrial and Technical Communication Administration] of the republic and representatives of scientific research and educational institutes participating in the seminar.

A considerable role in the achievements of communication workers in the Tenth Five-Year Plan belongs to the communication workers of the Russian Federation, who did much for the implementation of the program for improving the effectiveness and quality of production mapped out by the 25th CPSU Congress.

Having opened the seminar, G. S. Voloboy, director of GUSTS [Main Administration of Rural Telephone Communications] of the RSFSR Ministry of Communications, summarized the results of the fulfillment of the tasks of the five-year plan in the republic. Progress has been made in its facilities of electrical and postal communications, television, broadcasting, and Soyuzpechat' [Main Adminstration for the Distribution of Publications]. For example, the length of telephone channels on the oblast communication lines of the Russian Federation increased during the Tenth Five-Year Plan by a factor of 1.6 against 1.3 of the plan. The capacity of city and rural telephone stations in the republic increased almost by three million numbers. The task of increasing the number of receiving points of newpaper pages by the phototelegraphic method was fulfilled ahead of schedule, in 1979. The five-year plan of the introduction of powerful television stations was fulfilled one year ahead of schedule.

The five-year plan for increasing the capacities of telephone stations in rural areas was overfulfilled by 4.6%. The task of the construction of telephone facilities in rural areas of the Nonchernozem Zone was fulfilled in 4 years and 9 months.
The task for the construction of telephone intercommunication facilities (VPTS) in kolkhozes and sovhozes was overfulfilled.

Much work has been done to ensure smooth operation of rural communications and improvement of the quality indexes of this subbranch. In May 1979, an All-Union conference was held in Krasnodar on the problems of improving the operation of rural telephone communication (STS) facilities on the basis of new progressive methods (see "ELEKTROSVYAZ'", 1979, No 9). As a result of this conference, "Basic Principles of Centralized Operation of Rural Telephone Communication Facilities" was prepared for publication. The development of a complex of equipment for technical control of STS facilities, the introduction of new equipment and improvement of the existing equipment contribute to the improvement of the effectiveness and operation quality of rural telephone networks. During the years of the last five-year plan, experimental operation of an "Istok"-type ATS [automatic telephone exchange] was completed and the introduction of the following equipment was started: IKM-SVCh [pulse-code modulated-microwave] radio relay equipment of the "Radan" and "Oktaedr" types, transmission systems for cable lines IKM-15 and "Zona" and for aerial networks -- VO-12-Ye2. Experimental operation of cables KSPPZTs with signal conductors and TSPZPB 5X2X0.9 with aluminum-copper conductors was conducted. In 1981, the republic's networks received the first few hundreds of kilometers of this cable.

The reliability of STS networks depends greatly on the condition of external plants, on their timely overhaul and maintenance. Unfortunately, not everything is satisfactory in this area: not all PTUS of the republic fulfilled the plan for line repairs. There is insufficient control on the part of ETUS (RUS) [operational and technical communication centers (rayon communication centers)] over the correctness of the initial accounting and quality of services to the population with STS facilities; much damage to external plants is caused by other organizations; there is insufficient local control over the quality of the delivered equipment; no formal claims are presented to plants manufacturing substandard quality equipment. All these problems require serious attention of the specialists in rural telephone communications.

In 1981-1985, it is planned to build rural telephone networks for general use covering rayon centers located in villages and VPTS [telephone intercommunication] networks in sovkhozes and kolkhozes with a total capacity of about 800,000 numbers, including about 300,000 numbers in the Nonchernozem Zone of the RSFSR. It is planned to put into operation ATS for general use in rural areas, including quasi-electronic, with a total capacity of 405,000 numbers; to replace manual telephone exchanges with automatic exchanges; to bring the level of automation in rural telephone communications to 98%; to construct, expand, and reconstruct VPTS networks in more than 4000 sovkhozes and kolkhozes. Work is continued on the introduction of a centralized method of STS services and a complex system of communication quality control in STS networks. Successful solution of these complex problems will ensure the growth of effectiveness and quality of operation in rural telephone networks.

V. L. Mikhalev, assistant director of the GRU of the RSFSR Ministry of Communications, reported on the fulfillment of the tasks of the Tenth Five-Year Plan and on the prospects for the development of wire broadcasting. He noted that the tasks of the Tenth Five-Year Plan for the development and improvement of wire broadcasting (PV) in the Russian Federation have been completed successfully. The plan for increasing the number of wire-broadcast loudspeakers was overfulfilled. They were installed in 1670 settlements. Multiprogram wire broadcasting was developed further and can be enjoyed by the population of more than 340 cities and city-type settlements of the republic. More than 3000 rural radio wire broadcasting centers (RTU) were automated and changed to remote control, which made it possible to relieve about 3500 units of attending personnel. Great successes were achieved in the complex solution of problems of automating rural radio centers by the radio specialists of Tul'skaya, Gor'kovskaya and Kuybyshevskaya oblasts.

However, there are some shortcomings in the organization of the operation of wire broadcasting facilities. The problems of automating rural rediffusion stations are not solved in an integrated manner everywhere, which lowers the effect of the implemented measures. There are no clear recommendations for the optimization of the formation of centers of wire broadcasting networks in the rayons for the purpose of reducing the length of the lines. There are long interruptions in the operation of wire broadcasting loudspeakers due to the demolition of PV lines during the reconstruction of electric power networks and other construction jobs. Subscribers' loudspeakers are not produced by the industry in sufficient quantities.

In the Eleventh Five-Year Plan, wire broadcasting, including multiprogram broadcasting, will be developed further. It is planned to change all rural radio centers to remote control and complete automation. Long-range plans will be developed for providing radio broadcasting services to the rayons with consideration for the optimization of the formation of centers in the networks, reducing the length of wire broadcasting lines, and organization of the delivery of programs of rayon broadcasting to the radio centers of the rayon. A wide dissemination of production experience will make it possible to increase the effectiveness and quality of operation of PV facilities.

The problems touched upon in the main reports were developed further by the participants of the seminar. The following problems were discussed: improvement of the effectiveness and quality of STS and PV operation in application to the conditions of various oblasts of the RSFSR; special characteristics of the sets of equipment of the system of centralized technical control of STS networks and the introduction of control systems; ways of introducing a complex quality control system for STS operations; experience in the operation of transmission systems with pulse-code modulation for rural telephone networks; modern methods of cabling local telephone networks; problems of the organization of rayon broadcasting at automated rural radio centers controlled through an ultrashort-wave channels; possibilities of reducing the volume of external plants for wire broadcasting in rural areas.

There was a helpful exchange of opinions among the specialists in rural telephone communications and wire broadcasting, and recommendations were developed for solving urgent problems, such as the improvement of the quality of STS and PV and the growth of labor productivity of each enterprise.

10233
CSO: 5500/1005

USSR

AUTOMATIC TELEPHONE EXCHANGE 'KVANT' FOR AGENCIES, INDUSTRY DISCUSSED

Moscow ELEKTROSVYAZ' in Russian No 9, Sep 81 pp 62-63

[Article by G. Matlin: "Scientific and Technical Seminar on the Administrative and Industrial Automatic Telephone Exchange 'Kvant' of a Quasi-Electronic System"]

[Text] The section of industrial communications of the Central Administration Board of NTORES [Scientific and Technical Society of Radio Engineering, Electronics and Communications] imeni A. S. Popov held a scientific and technical seminar in Riga in April 1981 on the "Kvant"-type automatic telephone exchange of a quasi-electronic system developed and produced by the Riga Order of Lenin Production Association VEF [Electrical Engineering Plant] imeni V. I. Lenin to be used in agencies and industry in various sectors of the national economy.

The seminar was attended by more than 150 specialists representing 14 union and republic ministries, 35 largest industrial enterprises (Magnitogorsk and Noril'sk metallurgical combines, Automobile Plant imeni Likhachev, and others), 30 research, design, and educational institutes, and other organizations. Opening addresses were given by P. O. Vidoniks, deputy general director of the VEF Association, and V. N. Roginskiy, member of the board of NTORES imeni A. S. Popov.

Specialists of the design bureau of the VEF Association reported on the special characteristics of the KE ATS [quasi-electronic automatic telephone exchange] "Kvant" for agencies and industrial enterprises, the composition of its equipment, its programs, organization of additional services, procedures of its designing, installation, and its start-up and adjustment work.

The participants of the seminar familiarized themselves with the state of series production of the "Kvant" equipment. It was mentioned that its development and introduction signify a new qualitative stage in the development of the techniques of industrial communications which opens up fundamentally new possibilities in the application and operation of telephone exchanges at industrial enterprises, in transportation, and in construction. KE ATS "Kvant" is based on modern elements and controls the process of establishing a connection with the aid of specialized computers on the basis of appropriate programs; its users are provided with a set of additional services most of which are accomplished by means of programs; the complex of programs makes it possible to determine failures without the participation of operating personnel.

At the same time, it was established that the introduction of "Kvant" at industrial enterprises causes some definite difficulties some of which must be eliminated by modifying its design, and others by implementing organizational measures. "Kvant" exchanges require the presence of storage batteries i.e., a buffer mode of electric power supply, because the executive program and the stored information are lost if the power supply stops even for a short time. The restoration of the executive program requires some time in the course of which the exchange cannot operate. The existing programs of the exchange do not provide for the automation of the process of clearing the memory devices of erroneous, excessive, and other unnecessary information which accumulates constantly in the process of establishing the connections. Among other things, this necessitates the presence of operators, which lowers sharply the economic indexes of the exchange.

The high initial cost of the equipment and the previously unforeseen expenses on maintaining operators lower the economic indexes of the exchange and complicate the process of its introduction. The situation is particularly grave for the customers who were counting on the installation of a low-capacity ATS (64, 128, 256 numbers).

Most likely, the delivery of an ATS of a new generation, to which "Kvant" belongs, cannot be approached from the same position as the delivery of YATS-49 [universal automatic telephone exchange-49]or ATSK-100/2000 [crossbar automatic telephone exchange-100/2000]. The exchange cannot operate without a complete set of equipment including a special device for information input (output) to specialized computers. Therefore, many specialists rightfully insisted that KE ATS "Kvant" should be delivered with a complete set of its entire equipment regardless of the manufacturers of its individual types, and this was reflected in the recommendations passed at the seminar.

It was also noted that no optimal solution has been yet achieved on the problems of the organization of centralized operation of the exchange in the case of its mass introduction, there is no sufficient information on the designing, installation and operation of the "Kvant", and there are no necessary materials for the buyers of the exchange.

The seminar recommended, among other things, to introduce a course on quasi-electronic automatic telephone exchanges in electrical engineering institutes and communications tekhnikums.

10,233
CSO: 5500/1005

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